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1.050.635



PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Foamed Plastics Containers

We, THE DOW CHEMICAL COMPANY, a Corporation organised and existing under the Laws of the State of Delaware, United States of America, of Midland, County of Midland, State of Michigan, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates generally to plastics containers with false bottoms and bead-like lips and, more particularly, relates to foamed plastics containers with features especially adapted for vending machines, and a method and apparatus for forming the same.

While in the past it has been relatively simple to form plastics film containers with false bottoms for purposes of rigidity, stacking and appearance, such simplicity of forming has not been present with foamed plastics containers, such as cups, because of uneven flow and other unpredictable characteristics of foamed plastics material. Since in the past it has been difficult to control side wall thickness of such material by an economical, vacuum forming technique, such cups previously have been generally avoided in vending machine use. Because of the prior necessity of employing matched dies to have some degree of control in forming from foamed plastics sheets and, further, because of the design required for stacking shoulders in false bottom cups which has been unobtainable in matched die forming, false bottom cups of foamed plastics material previously have been impractical to manufacture by this method also. The novel vacuum forming plug die technique of this invention has eliminated that impracticability.

In addition, in the prior conventional method of forming containers from non-foamed plastics sheet, the bottom could only be formed after the sheet had been drawn into the bottom of the forming mold while, in the present invention, the bottom of the container can be

formed first in the forming cycle or at any later time to gain the desired bottom characteristics. Any other physically acceptable technique, such as by foaming in place or by injection molding, has proven to be too expensive to be practical; the relative cost thereof being approximately ten times as great as that for producing foamed plastics containers according to the techniques of the present invention. Furthermore prior teachings have not been able to provide for an efficient and effective enough bead-like lip on foamed plastics containers to render them practical for vending machine operation.

The containers of the present invention are economical, readily dispensable from a vending machine, and conveniently stacked. The invention includes a process and apparatus for the manufacture of said containers, whereby the thicknesses of the side wall and of the bottom wall are controlled by the use of vacuum, and whereby a bead-like lip is formed about the periphery of the containers.

The present invention provides a frusto-conically shaped container of foamed plastics material having a side wall extending between upper and lower peripheries, said side wall being inclined inwardly from said upper periphery to said lower periphery and said lower periphery defining an integral generally recessed centre portion forming a bottom wall, in which container the upper periphery is in the form of a bead-like lip and a reinforcing gusset is formed integrally between said lower periphery and said bottom wall, the configuration of said lower periphery being essentially concentric with and smaller than the configuration of said bottom wall, whereby said container can be nested with another of identical shape by the lower periphery of one resting upon the upper surface of the bottom wall of the other.

The invention also includes a method of forming a nestable frusto-conically shaped foamed plastics container with a false bottom

[Price 4

which method comprises (a) heating a sheet of foamed plastics material to a formable temperature, (b) placing the sheet under a plug body or male die having a recessed bottom and a peripheral flange portion, (c) creating a vacuum between the sheet, said recessed bottom and the flange portion, (d) advancing the plug body of the container into a mould cavity to complete formation of the side wall of the container, (e) creating a vacuum between said sheet and the bottom of said cavity acting in a direction generally opposite to said first-mentioned vacuum. The invention also includes apparatus for forming false bottom nestable containers, comprising a female mould having a generally frusto-conically shaped cavity; a plug body or male die having a generally frusto-conically shaped body substantially complementary to said cavity and adapted to enter thereinto and remain spaced therefrom, the entry end of said plug body having a central recess defining a peripheral flange portion, the outer peripheral edge of said flange portion having a configuration substantially concentric with and of a size less than the innermost configuration of said recess and said plug body including an air passageway from said recess for creating a vacuum and for blowing ejection air therethrough.

Briefly, then, the present invention comprehends a false bottom foamed plastics container with a bead-like lip. The side walls of the container are inclined and extended beyond the actual bottom of the container such that the diameter of the periphery of the extension is less than that of the actual bottom thereof to provide for releasable nesting of a plurality of such containers within one another. Apparatus of this invention forms the above bottom configuration prior to completion of the forming of the side wall employing single and double vacuum drawing in dies to provide a controlled bottom weight and thickness. The apparatus also provides for controlled side wall thickness. A vacuum technique for forming a desirable bead-like lip while the container is in its forming die is additionally provided.

The invention is more fully explained with reference to the accompanying drawings, in which:

Figure 1 is a elevational view of a cup of foamed plastics material formed according to the principles of the present invention;

Figure 2 is a top view thereof.

Figure 3 is a bottom view thereof;

Figure 4 is a cross-sectional view of a plurality of cups like that of Fig. 1, in a stacked relationship, with the cross-section of each cup being as if taken along the reference line 4-4 of Fig. 1;

Figure 5 is a cross-sectional view of assembled apparatus of the present invention prior to the forming of a cup;

Figure 6 is a view similar to Fig. 5, only

showing the apparatus in a subsequent step of forming the bottom wall of the cup;

Figure 7 is still another view like Fig. 5, only showing a step subsequent to that shown in Fig. 6, of forming the side wall of the cup; and

Figure 8 is yet another view like Fig. 5, only showing a final step of forming a bead-like lip for the cup.

Referring now more particularly to Figs. 1 to 4, container 10 is shown in an exemplary form as a frusto-conically shaped cup formed of a foamed plastics material, such as expanded polystyrene.

Since container 10 is particularly adapted for automatic vending machine dispensing, it includes, at the upper periphery of its side wall 12, a bead-like lip 14 for engagement by fingers of a vending apparatus.

Container 10 also includes a false bottom 16 extending somewhat inwardly from the bottom periphery of the container formed by the circular foot 18 such that the diameter, or other configuration if foot 18 is other than circular, is concentric with and smaller than the diameter of false bottom 16. This permits stacking of one container within the other, that is, the foot of an upper container resting upon the bottom of the next lower container, as illustrated in Fig. 4.

Preferably the container includes a gusset portion 20 between foot 18 and the upper surface of the bottom 16, for purposes of rigidity. It is to be understood, however, that the size of the gusset is relatively immaterial, it serving the same function even if it formed as a solid fill-in between the foot 18 and the bottom 16, provided economics permits the additional material to be used.

Referring now more particularly to Fig. 5, the apparatus 22 for forming a container 10 basically includes a female die mold 24, a male die or plug body 26 and a trimmer and rim former 28, with the apparatus being shown in its open state preliminary to forming a container. Associated with plug body 26 is a shaped insert member 30 of trapezoid cross-section having an upper periphery 32 substantially conforming to a portion of the bottom periphery 34 of the plug body 26 but spaced therefrom to provide an air passageway 36. Member 30 is held in this position by being secured to the lower end of a shaft 38 which is threaded through plug body 26. Plug body 26 in turn, is preferably slidably engaged at its upper end to former 28.

Passageway 36 is connected with an internal passageway 40 within shaft 38 through which a vacuum can be drawn or air introduced when desired. Other air passageways 48 can be employed from the side of plug body 26 for providing better control in forming and/or in removal of a formed container. Mold 24 can also be provided with air passageways 43 and 45, the use of which is described hereinafter.

The use of passageways 47 and 49 of former 28 are also later described.

5 Plug body 26 includes a peripheral flange 42 with its inside surface substantially parallel to its outside surface. Flange 42 is formed of such a length that the outer peripheral edge 44 of the plug body has a diameter less than the inner peripheral corner 46 of the body.

10 Trimmer and rim former 28 is constructed so as to be slideable up and down shaft 38, being controlled by an air cylinder separate from that which controls plug body 26 (neither air cylinder being shown), and has an internal hollow diameter X just great enough to clear 15 the outside external periphery of plug body 26, but small enough to seat about the upper portion of plug body 26 when engaged thereon. While former 28 can also be fixed to shaft 20 38 at a spaced distance above plug body 26 so that when the plug is fully lowered the former comes down the proper distance to perform simultaneously its bead forming function, later described, this has not been found preferable in practice although it is considered to 25 be within the scope of the present invention.

Pocket 50 is provided within mold 24 about the periphery of the mold cavity for entry of projecting flange 52 of the former 28, the bottom of the flange 52 and the bottom of the 30 pocket 50 being cooperatively and oppositely formed, reversely concave to one another, with curved surfaces 54 and 56. Outer edge 58 of flange 52 is formed sharp enough so as to cut through a foamed plastics sheet and act as a 35 trimmer.

In forming container 10, a sheet 60 of foamed plastics material is placed across the top surface 62 of mold 24 and clamped (not shown) thereto, when plug 26 and former 28 are withdrawn therefrom. The sheet 60 engages top surface 62 in a heated condition and as the hot plastic sheet is forced by the plug body 26 into the forming cavity of mold 24, as shown in Fig. 6, or just prior thereto, a 40 vacuum is drawn through passageways 36 and 40 to form false bottom 16, thus providing the stacking feature of container 10. The exact timing of drawing the vacuum on the plug can be varied to obtain the desired sheet thickness of the false bottom, that is, the further down 45 the plug travels before a vacuum is created above the bottom wall, the thinner that wall will be. Thus, a false bottom of the desired weight, once formed, maintains its shape and 50 thickness despite the further forming of the side wall 12 of container 10 as the plug continues to descend, as illustrated in Fig. 7, to the bottom position shown in dotted lines. Former 28 does not continue all the way down 55 with plug body 26, but remains in an upper position until the step illustrated in Fig. 8, discussed hereinafter, is effected. Once the side wall 12 is formed, a vacuum can be drawn through passageway 45 whereby the foam on 60 the underside of the bottom 16 expands to

form the gussets 20 and the bottom wall to any desired thickness since vacuum can be drawn on both sides of the false bottom 16.

Once the side wall 12 and bottom 16 are 70 formed, trimmer and former 28 descends, as shown in Fig. 8, shearing the upper periphery of the cup from sheet 60 with trimming edge 58 cutting against corner 66 of mold 24. After the trimmer shears the container from sheet 60, the flange 52 continues to descend, com- 75 pressing the still heated foamed plastics material between corresponding radii 54 and 56, to form bead-like lip 14. While an effective bead can be formed from no more than the above described action, a bead of a desired 80 thickness and density can preferably be obtained by controlling a vacuum drawn through passageway 47 from curved surface 56, and thence out port 49, and a vacuum drawn on 85 the reverse side of the bead-like lip 14 through passageway 43 from curved surface 54, out through mold 24. The opposite pulling effect of the two vacuums thus provides for a uniform cross-sectioned and full-shaped bead-like lip.

Thence the plug 26 and former 28 are withdrawn to the starting position shown in Fig. 5 wherein the finished cup or container 10 is 90 ejected. This ejection can be obtained by blowing air through passageways 36, 40 and 48 of the plug body as it is being withdrawn from the mold cavity to release the cup therefrom, which still remains in the mold, and then blowing air into the mold cavity through passage- 95 ways 43 and 45 to eject the cup. Another way to eject the cup is achieved by maintaining the vacuum through the plug body passageways 36, 40 and 48 while it is being withdrawn with the formed cup thereon, with air simulta- 100 neously being blown into the mold cavity through passageways 43 and 45 if desired, and then, when the plug body is fully withdrawn, releasing the vacuum and blowing air through passageways 36, 40 and 48 to release the cup 105 from the plug body 26.

Accordingly, it can be seen that a well-controlled and formed cup body, including stacking features, a desired bottom weight, a controlled bead-like lip and a controlled wall 110 thickness can be readily formed.

WHAT WE CLAIM IS:—

1. A frusto-conically shaped container of foamed plastics material having a side wall extending between upper and lower peripheries, said side wall being inclined inwardly from 120 said upper periphery to said lower periphery and said lower periphery defining an integral generally recessed centre portion forming a bottom wall, in which container the upper periphery is in the form of a bead-like lip and 125 a reinforcing gusset is formed integrally between said lower periphery and said bottom wall, the configuration of said lower periphery being essentially concentric with and smaller than the configuration of said bottom wall, 130

whereby said container can be nested with another of identical shape by the lower periphery of one resting upon the upper surface of the bottom wall of the other.

5 2. A container as claimed in claim 1 wherein the foamed plastics material is an expanded polystyrene.

3. A method of forming the nestable frusto-conically shaped container of foamed plastics material according to claims 1 or 2, which method comprises (a) heating a sheet of foamed plastics material to a formable temperature, (b) placing said sheet under a plug body having a recessed bottom and a peripheral flange portion, (c) creating a vacuum between said sheet, said recessed bottom and said flange portion, (d) advancing the plug body into the cavity of a female mould to complete formation of the side wall of the container, (e) creating a vacuum between the sheet and the bottom of the cavity acting in a direction generally opposite to said first-mentioned vacuum.

4. A method as claimed in claim 3 wherein the upper periphery of the container is separated from the sheet after the plug body has been advanced into the cavity of the female mould and the upper periphery is compressed between corresponding curved surfaces of the plug body and the female mould to form a bead-like lip.

5. A method as claimed in claim 4 wherein simultaneously with the compressing of the upper periphery, a vacuum is applied to each of said surfaces to provide a lip of uniform shape and density.

6. Apparatus for forming false bottom nestable containers comprising a female mould having a generally frusto-conically shaped cavity; a plug body having a generally frusto-conically shaped body substantially complementary to

said cavity and adapted to enter therein and remain spaced therefrom, the entry end of said plug body having a central recess defining a peripheral flange portion, the outer peripheral edge of said flange portion having a configuration substantially concentric with and of a size less than the innermost configuration of said recess and said plug body including an air passageway from said recess for creating a vacuum and for blowing ejection air there-through.

7. Apparatus as claimed in claim 6 wherein the female mould is provided with an air passageway from said cavity; for creating a vacuum and for blowing ejection air there-through.

8. A method of forming nestable frusto-conical shaped foamed plastics containers as claimed in claim 3 substantially as described with reference to the accompanying drawings.

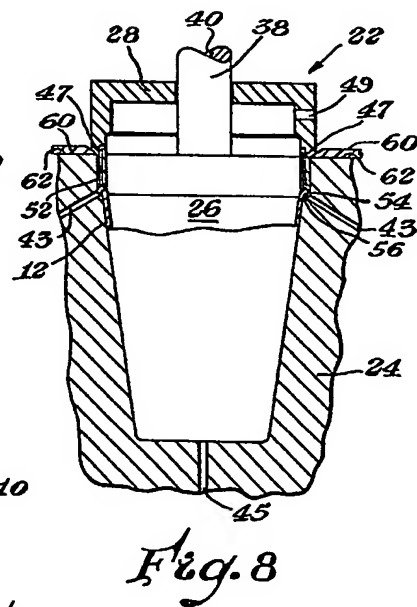
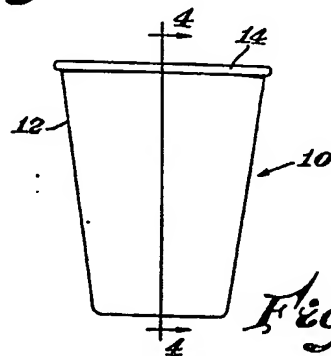
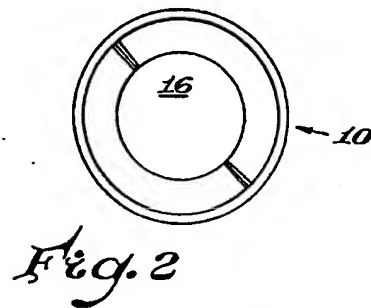
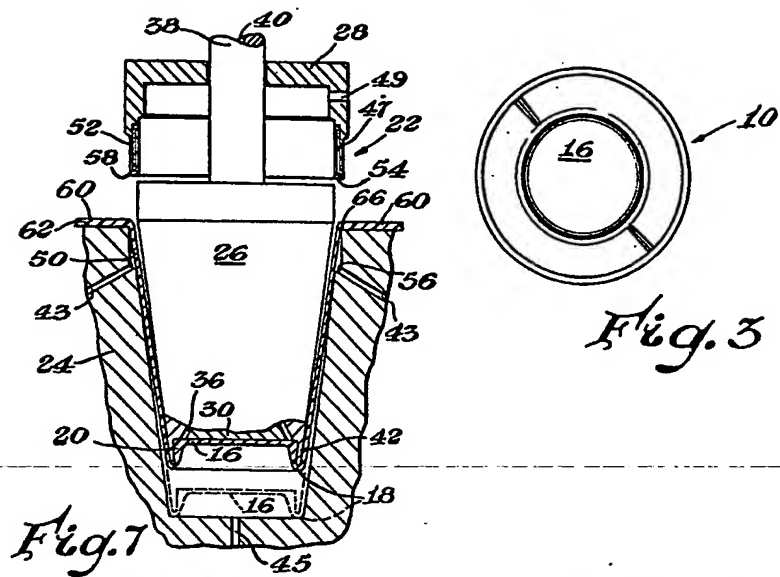
9. Apparatus for forming false-bottom foamed plastics nestable containers substantially as described and illustrated in Figures 5, 6, 7 and 8 of the accompanying drawings.

10. Frusto-conically shaped foamed plastic containers whenever prepared by the method claimed in any one of claims 3, 4, 5, or 8.

11. Frusto-conically shaped foamed plastics containers whenever prepared by means of the apparatus claimed in any one of claims 6, 7 or 9.

12. Frusto-conically shaped foamed plastics containers substantially as described and illustrated in Figures 1, 2 and 3 of the accompanying drawings.

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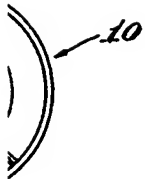


Fig. 3

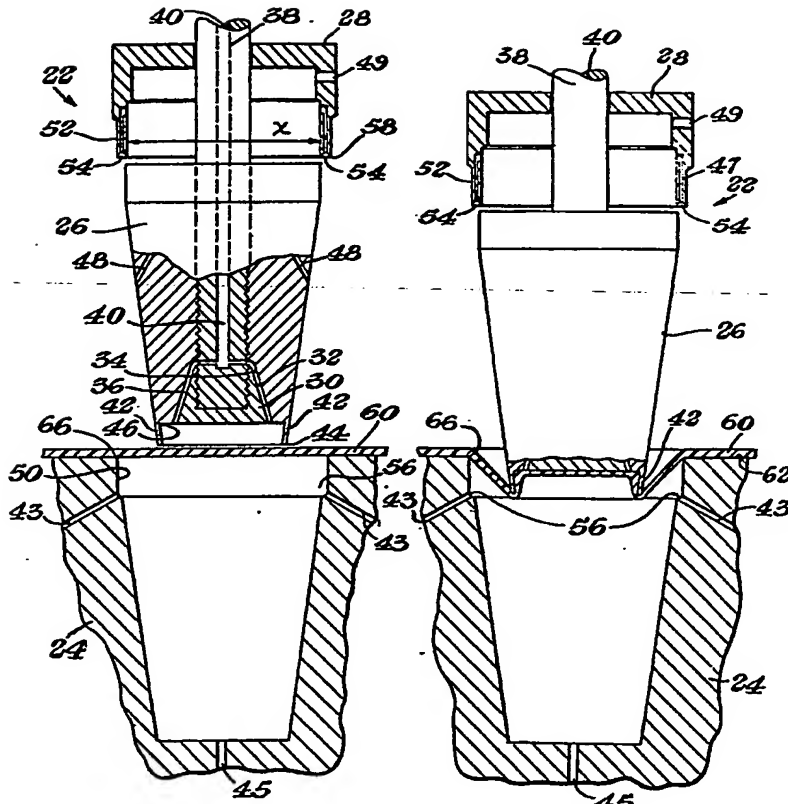
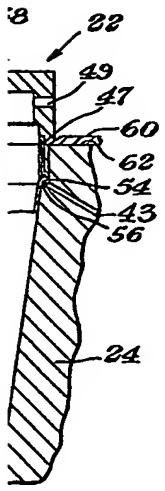


Fig. 5

Fig. 6

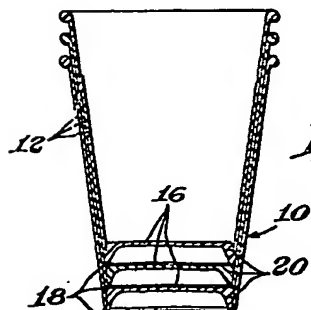


Fig. 4

